DETAILED ACTION

Claim Objections

1. Claim 4 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 1 already provides for a "periodic diffractive structure extending over the entire pigment with a defined spatial frequency and spatial alignment" as found in claim 4.

2. Claim 40 is objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim should not refer to two sets of claims to different features. See MPEP § 608.01(n). Accordingly, the claim has not been further treated on the merits.

3. Claim 43 is objected to because of the following informalities: "polyethylene naphtalate" should be rewritten as "polyethylene *naphthalate*."

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1, 3-6, 8-9, 12-14, 16, 18-24, 29-30, 33-34, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Josephy et al. (6398999) in view of Lee (5912767).

6. Regarding claims 1, 3-6 and 18:

7. Josephy et al. (herein Josephy) disclose flakes that may be used in inks or paints, i.e. pigments (col 1 ln 19-21). The flakes may be embossed with a holographic or diffraction grating pattern (col 10 ln 42-45). Other layers will share this pattern, i.e. Josephy graphoepitaxially applies said layers (col 10 ln 46-48). In light of the high aspect ratio (col.1, lines 17-20), the examiner considers flakes to be platelet shaped, and notes that on one side of the flake structure a surface area that is the entire surface area for that side exists. The examiner also considers Jospehy's flakes having a holographic pattern to be "cutouts" from a hologram.

8. Josephy is silent with regard to a cutout from a hologram having a periodical diffractive structure stretching itself over the entire pigment, said structure being an overlay of differently determined spatial frequencies and spatial alignments.

9. Lee discloses diffractive indicia with dimensions on the order of 10 microns, for use in inks (col 1 ln 56; col 2 ln 14). The diffractive structure comprises concentric circular grooves, or concentric regular polygonal grooves (col 2 ln 31-34). Depending on the optical properties desired, the spacing between groove can be modulated and/or of different spatial frequencies (col 2 ln 35). The grooves do not need to be continuous (col 4 ln 42). Lee also teaches one can create an optical ("picture-switch") effect by "overprinting" (overlaying) a diffractive pattern onto another diffractive pattern (col 4 ln 24-31).

10. Josephy discloses examples wherein flake size of 3 by 2 microns are produced (col 11 ln 43). 2 microns equates to 2000nm, and thus is a measurement greater than a multiple of 400nm.

11. The flakes can have different multi-layer embodiments, including (2) release/ protective layer/metal/protective layer/release (col 7 ln 11). The two protective layers are interpreted to be Applicant's sealant material. Examples of protective material include silicon dioxide and titanium dioxide, both of which intrinsically possess optical permeability (col 6 ln 4-9). The protective layer, as well as others, may be applied by EB (electron beam) deposition to grow thin coatings (col 6 ln 19-23).

12. One of ordinary skill in the art would clearly envisage a periodic diffractive structure with a defined spatial frequency and spatial alignment from the use of "diffraction grating" by Josephy because that describes the intrinsic properties of a diffraction grating (col 10 ln 42-45).

13. At the time of the invention, it would have been obvious to one of ordinary skill in the art to vary the spatial frequencies and alignments of the grooves of Josephy's diffraction gratings to change the optical properties of the flakes. Also, it would have been obvious to overlay one diffractive structure on another to arrive at what Lee calls a "picture-switch effect," and further use this in the hologram of Josephy's flakes.

14. Regarding claims 8 and 9:

15. At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine Josephy's teaching of metal flakes with Lee's teaching to create concentric diffractive patterns on said flakes to create a desired optical effect.

16. Regarding claims 12-14:

17. Josephy teaches that the protective layer forms a hard clear coat (col 5 ln 52). The term "clear" denotes an optically permeable substance.

18. Since Josephy teaches that the flakes may be "embossed" with a diffraction grating, such a grating would necessarily be defined by the thickness of the flake (or pigment), i.e. the grooves would be a result of rises and depressions in the material.

19. Metal coatings are provided, including those of aluminum, copper, silver-all reflective materials (col 5 ln 64). Furthermore, reflection enhancing stacks (layers of highly reflective materials) may be used (col 5 ln 66+). The reflective metal layers would take on the diffractive grating structure (col 10 ln 45).

20. Regarding claims 16 and 41:

21. One embodiment produces aluminum flakes about 4x12 microns in size (col 9 ln 39). The 12 micron dimension anticipates a size of 5-200 microns and a size of 10-30 microns.

22. Regarding claim 19:

23. Josephy discloses multiple layers, all of which share the diffraction pattern, i.e. Josephy graphoepitaxially applies said layers (col 10 ln 46-48). Therefore, the aluminum and protective (sealant) layers both have a defined diffractive structure.

24. Regarding claims 20-22:

25. Josephy teaches the protective coating is an inert, insoluble inorganic material (col 5 ln 51). Furthermore, the flakes can be made moisture-resistant by the outer protective coat (col 10 ln 2). Also, silicon dioxide, a hydrophilic material, can comprise the protective coating (col 9 ln 49).

26. Josephy is silent, however, with regard to using a hydrophobic layer, making one layer hydrophobic and the other hydrophilic.

27. One of ordinary skill in the art would recognize that a hydrophobic substance would provide a moisture-resistant protective coating; it inherently repels water. One of ordinary skill would also recognize

the two protective coatings (one on each side) come from two independent sources (Fig. 2, **46**, **50**; col 4 ln 40). If only one side needed to be moisture resistant, then one could simply use a hydrophobic substance in one source, and a hydrophilic substance like silicon dioxide in the other.

28. At the time of the invention, it would have been obvious to one of ordinary skill in the art to make use of a hydrophobic substance to improve moisture resistance, and also use two different materials for each protective coating, one being hydrophobic, the other being hydrophilic.

29. Regarding claims 23-24:

30. To create the flakes as described, the carrier is embossed (stamped) with a diffraction grating, the subsequently applied layers replicate the grating pattern (col 10 ln 42-48). The examiner considers this to be equivalent to “reaction embossing”. Also, it is well known in the art to apply heat during embossment (hot stamping) to make a better impression. The multi-layer sheet may then be ground (pulverized) into flakes (Fig. 5; col 3 ln 4). One of the layers may be reflective, as described previously.

31. The electron beam deposition described above is a form of vapor deposition.

32. Regarding claim 29:

33. One of ordinary skill would recognize that metal would be an acceptable protective material, as it is inert, insoluble and inorganic. Josephy teaches one can vapor deposit metal layers for the formation of the internal metal layer (col 5 ln 59).

34. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use metal as a protective coating for Josephy’s flakes, and apply the metal by vaporizing the metal.

35. Regarding claim 30:

36. Josephy is silent, however, with regard to snipping the foil flakes.

37. One of ordinary skill in the art would recognize that one could snip the flakes off the original sheet if desired.

38. At the time of the invention, it would have been obvious to one of ordinary skill in the art to snip the aluminum sheet into flakes.

39. Regarding claim 33:

40. Josephy teaches that aluminum flakes can be made using ball milling, wherein the flakes are in a slurry-a mixture of solid and liquids, i.e. they can be made by wet pulverization (col 1 ln 28-30).

41. Regarding claim 34:

42. The inks and paints that use the described invention, would inherently be made of a pigment powder of the described flakes (col 1 ln 19-21). Regarding the limitation of the present claim 34, step (b), Josephy teaches the reflective metal layers may be vapor deposited (col 5 ln 59-61).

43. Claims 2, 7, 26, 35, 37-40, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Josephy et al. (6398999) in view of Lee (5912767) as applied to claims 1, 3-6, 8-9, 12-14, 16, 18-24, 29-30, 33-34, and 41 above, and further in view of Miekka et al. (6068691).

44. Josephy in view of Lee discloses aluminum flakes having a diffractive structure as described previously.

45. Josephy and Lee are silent, however, with regard to the diffractive structure being used for UV light, the flake thickness claimed, and the ability to create the diffractive structure by scratching. Josephy and Lee are also silent with regard to substances containing said powder, and documents containing said substances.

46. Miekka et al. (herein Miekka) disclose embossed metallic flakes useful for security applications (col 3 ln 43). The diffractive structure has between 5,000-11,000 grooves per cm (claims 8, 12). One technique for making diffractive gratings is by scribing lines on a metal surface (col 3 ln 7).

47. Regarding claims 2 and 7:

48. The smallest measurement of Josephy's flakes are 2,000nm as described previously. This is at least a multiple of 800nm. The diffractive structure described by Miekka would affect both UV and visible light: the groove density (5,000-11,000 grooves per cm) corresponds to a groove period of 909-2,000nm. (Note the groove density is the inverse of groove period.) The groove period must be on the order of the wavelength of light intended to be used with the diffraction pattern. Thus, the grating described could be used for both UV and visible light.

49. At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine Josephy's general teaching of creating a diffraction pattern on a metal flake with Miekka's teaching of a flake having the specified groove period to affect both UV and visible light.

50. Regarding claim 26:

51. Miekka discloses that the early diffraction gratings can be scribed into the metal. Such processes are still available to one of ordinary skill in the art.

52. At the time of the invention, it would have been obvious to one of ordinary skill in the art to create the diffraction gratings present in Jospehy's flakes by scribing (scratching), as shown in Miekka because of its simplicity.

53. Regarding claims 35 and 39:

54. Miekka discloses Example 13 wherein a lacquer comprises the aluminum pigment, an acrylic binder, and a wetting agent (col 10 ln 60+).

55. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use a wetting agent with Josephy's pigment flakes for its use in coatings and to use a plastic binder in said coatings to ensure the lacquer has good coating properties.

56. Regarding claims 37-38:

57. Miekka discloses that the aluminum pigments can be used in printing, lacquer and paints (col 11 ln 5).

58. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use Josephy's flakes in print colors and lacquer to provide inks having holographic patterns.

59. Regarding claim 40:

60. Miekka teaches that the flakes can be used for security applications (col 3 ln 43).

61. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use Josephy's flakes to create a pigment suitable for use as a holographic security tag for use on a document.

62. Regarding claim 42:

63. Although Miekka is silent with regard to the polymers named by Applicant in the present claim 42, one of ordinary skill in the art would recognize that such polymers could be used because each polymer is intrinsically transparent, and thus would be useful for a carrier medium of diffractive pigment.

64. Claims 1,3, and 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimoto et al. (US 6,112,388) in view of Lee (5912767) .

65. Regarding claims 1 and 3:

66. Kimoto et al. (hereafter Kimoto) disclose metallic flakelets for holographic pigment (col 1 ln 7-9). The flakelets are embossed with a pattern and then covered with an organic-inorganic composite layer (col 1 ln 51-60). The pattern is the holographic pattern. The organic-inorganic composite layer is transparent (col 6 ln 66-67 through col 7 ln 1–4). The composite follows the contours of the pattern, i.e. is applied graphoepitaxially. The examiner considers Kimoto's flakes to be cutouts of a hologram.

67. Kimoto is silent with regard to a cutout from a hologram having a periodical diffractive structure stretching itself over the entire pigment, said structure being an overlay of differently determined spatial frequencies and spatial alignments.

68. Lee discloses diffractive indicia with dimensions on the order of 10 microns, for use in inks (col 1 ln 56; col 2 ln 14). The diffractive structure comprises concentric circular grooves, or concentric regular polygonal grooves (col 2 ln 31-34). Depending on the optical properties desired, the spacing between groove can be modulated and/or of different spatial frequencies (col 2 ln 35). The grooves do not need to be continuous (col 4 ln 42). Lee also teaches one can create an optical ("picture-switch") effect by "overprinting" (overlaying) a diffractive pattern onto another diffractive pattern (col 4 ln 24-31).

69. At the time of the invention, it would have been obvious to one of ordinary skill in the art to vary the spatial frequencies and alignments of the grooves of Kimoto's diffraction gratings to change the optical properties of the flakes. Also, it would have been obvious to overlay one diffractive structure on another to arrive at what Lee calls a "picture-switch effect," and further use this in the hologram of Kimoto's flakes.

70. Regarding claims 16-17:

71. The dimensions of the flakelets are 20 microns wide and "about" 0.1-0.3 microns thick (col 3 ln 15-25). Given that the term "about" provides for larger thicknesses, the examiner considers the disclosure of a thickness of about 0.3 microns to include 0.5 microns. Therefore, the range overlaps with present range. As set forth in MPEP 2144.05, in the case where the claimed range "overlap or lie inside ranges disclosed by the prior art", a *prima facie* case of obviousness exists, In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

72. Claim 25 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Josephy et al. (6398999) in view of Lee (5912767) as applied to claims 1, 3-6, 8-9, 12-14, 16, 18-24, 29-30, 33-34, and 41 above, and further in view of Kuwayama et al. (5035473).

73. Applicant claims that step (a) of the process in claim 23 is carried out by lithography.

74. Josephy discloses metal flakes having holographic or diffractive patterns, as previously described.

75. Josephy is silent, however, with regard to creating the diffractive grating by lithography.

76. Creating diffractive gratings via optical lithography was well-known in the art, for example, Kuwayama et al. disclose a diffraction grating created by lithography using a mask (col 2 ln 66). The use of a mask implies the lithography used is photolithography (optical lithography).

77. At the time of the invention, it would have been obvious to one of ordinary skill in the art to create the diffractive grating used in Josephy's flakes via lithography, as it was well known in the art to be capable of forming such gratings.

Claim Rejections - 35 USC § 112

78. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

79. Claim 23 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

80. Claim 23 recites the limitation "the foil-like medium" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim. Applicant appears to intend for the claim to read “snipping the structure” to reflect the amendments to the claims.

Response to Arguments

81. Applicant's arguments with respect to claims 1-40 have been considered but are moot in view of the new ground(s) of rejection.

82. The examiner withdraws the previous 35 USC § 112 rejections, as Applicant’s amendments and cancellations render said rejections moot.

83. Applicant submits that Josephy does not disclose a pigment that contains all of added limitations of claim 1 as amended. Furthermore, Applicant submits Josephy does not disclose the added limitations in claims 23 and 34. The examiner takes the position that Josephy does teach a cutout from a hologram, and that in view of Lee, it would have been obvious to one of ordinary skill to make diffractive structure comprising an overlay of frequencies and alignments as described in paragraphs 6-13 above. The examiner also takes the position that Josephy contains the limitations added to claims 23 and 34 as found in paragraphs 29-31 and 41-42 above respectively.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action

is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Freeman whose telephone number is (571)270-3469. The examiner can normally be reached on Monday-Friday 7:30-5:00PM EST (First Friday off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Callie Shosho can be reached on (571)272-1123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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